Fluid constraints in the Miguel Vacas Cu deposit (Ossa-Morena Zone, Portugal)

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The ancient *Miguel Vacas* copper mine belongs to a cluster of ancient Cu mines and occurrences in the Ossa-Morena Zone, specifically in the *Sousel-Barrancos* metallogenic belt (SBMB), such as *Mociços*, *Ferrarias* and *Bugalho*. This deposit is characterised by an anastomosing vein structure mainly composed of quartz + carbonate + sulphides that extends over 2 km in length with an NNW-SSE direction. Chalcopyrite is the main primary Cu mineralisation; strong supergene enrichment is evidenced by the mineral assemblage of libethenite, malachite, bornite and digenite. Prospects in the area also reveal the presence of arsenopyrite. An epigenetic epithermal model for the Cu mineralisation is proposed for *Miguel Vacas*, as well as for other SBMB deposits (Mateus et al., 2003). This study aims to the characterisation of the fluids related with the mineralising processes. Sampling was done in a borehole at different depths (eight samples from 53 to 188 m). This study allowed identifying three different FI types regarding their composition.

LVS_{1-3} where L and V is H_2O, S_1 corresponds to halite, S_2 is a carbonate and S_3 an opaque phase; most of the inclusions contain a halite crystal. LV consists of two-phase inclusions where L and V are H_2O. $L_{1-2}V$ where L_1 is H_2O; L_2 and V are CO_2. *Miguel Vacas* fluids studied in mineralised veins show a wide range of homogenisation temperatures (T_h= [62.8 – 350 ºC]; $\overline{x}$ = 181 ºC) and salinities ([0.35 – 30.9]; $\overline{x}$ = 17.89 wt% NaCl equiv.). First ice melting temperatures (T_e= [-68 – -14 ºC]; $\overline{x}$ = -46 ºC) suggest the presence of solutes such as $CaCl_2$ and $MgCl_2$.

LV microthermometry data allowed to differentiate between two major groups (LV-a and LV-b), enhancing that even though these inclusions are gathered in the same FI assemblage they belong to a different fluid pulse. LVS_{1-3} and LV-a inclusions were studied in quartz + calcite ore-bearing veins, with comb-zoned textures, where these fluids coexist. Figure 1 suggests mixing between high salinity (LVS_{1-3}) and lower salinity fluids (LV-a) (arrow trend), which may indicate different fluid sources present in the system. It should be emphasised that halite-bearing FI´s show $T_{h(L+V\rightarrow L)}$ at lower temperatures than halite melting (T_{mHal}= [83.1 – 181.4 ºC]; $\overline{x}$ = 144.7 ºC). LV-b FI´s are found in shallower milky quartz samples (53 and 65 m), close to a dolerite intrusion and are distributed in cluster assemblages. LV-b thermometric data advocate for a much different fluid source, perhaps related with the dolerite intrusion. Petrographic evidence suggests that this quartz crystallised earlier than the quartz + calcite + sulphides paragenetic sequence.

The fluid inclusions from the *Miguel Vacas*, as well as from the *Mociços* Cu deposit, suggest that Cu ore-bearing fluids in SBMB ancient mines share a similar source with an important contribution of magmatic fluids.

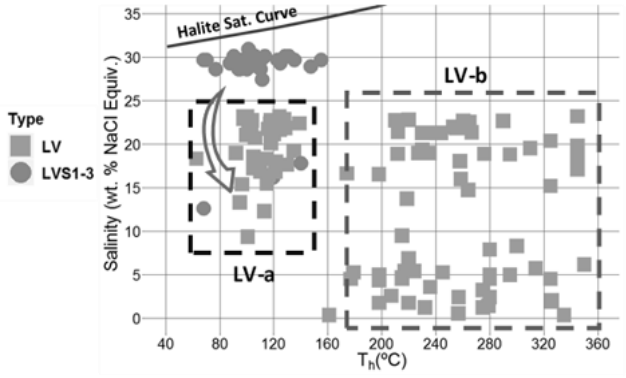

Fig. 1. *Salinity (wt% NaCl equiv.) versus T_h from the obtained data from the different Types of fluid inclusions.*

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References

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